

delicate to detect differences in the force of gravity in consequence of our being lifted farther from the centre of the earth every time by the terrain tide as it passed between our feet, could be established in conjunction with the experiments on earth-tremors.

JOHN MILNE

Imperial College of Engineering, Tokio, Japan

### Limulus

CONCERNING the systematic place of *Limulus*, I should like to draw attention to a habit which has, as far as I know, never been alluded to in discussions, viz. the manner of casting its skin, mentioned by me in *Deformation of Insects (Mem. Compar. Zoology)*. *Limulus* splits the skin exactly around the front margin of the head. Among Crustacea the Decapods at least split the skin around the hind margin of the carapace. Insects split the skin in the longitudinal middle line of the occiput and thorax, with the later addition of a transversal split on the head. I have seen cast skins of Scorpio, Pseudoscorpions, Hydrachna, and Arachnids, but they are not now at hand for a sure verification. As far as I remember all of them split the skin in the middle line of the anterior parts. At least I do not remember to have seen any transversal anterior split.

H. A. HAGEN

Cambridge, Mass.

### The Utilisation of Ants in Horticulture

DR. C. J. MACGOWAN has sent me from Han Chow, Province of Hainan, China, a little paper on the "Utilisation of Ants as Insect Destroyers in China." It seems that in many parts of the province of Canton the orange trees are injured by certain worms, and to rid themselves from these pests, the inhabitants import ants from the neighbouring hills. The hill-people throughout the summer and winter find the nests of two species of ants, red and yellow, suspended from the branches of various trees. The "orange ant breeders" are provided with pig or goat bladders baited inside with larid. The orifices of these they apply to the entrance of the bag-like nests, when the ants enter the bladders, and, as Dr. Macgowan expresses it, "become a marketable commodity at the orangeries." The trees are colonised by placing the ants on their upper branches, and bamboo rods are stretched between the different trees, so as to give the ants easy access to the whole orchard. This remedy has been in constant use at least since 1640, and probably dates from a much earlier period. This is certainly a new way of utilising ants, which as a rule are deservedly considered a nuisance by the horticulturist. I should like to learn from any entomological reader of NATURE whether the facts communicated have before been known in Europe, and, if so, whether the species of ant has been determined.

C. V. RILEY

Washington, D.C.

### Aurora Australis

APRIL 17.—Evening very dark; air close and sultry; thermometer at 65. About 6.35 p.m. noticed a broad sheath of dull rosy red in the south, stretching upwards towards the zenith; from south-east to south was spread a bright greenish-yellow glare, sufficiently luminous to enable us to read the figures of a lady's small watch. Shortly afterwards, the sky from east-by-south to south-south-west was illumined with a ruddy glow deepening to dark red; at the most easterly point of the auroral light were broad pulsating streamers of great brilliancy; these extended to south-east-by-east. Could not detect the slightest sound from aurora. Weather continued fine. April 20.—This evening there was a wide-spread glare of auroral light, with greater range, but of far less brilliancy than marked the grand display on the 17th. Weather fine and clear.

T. H. POTTS

Ohinitaki, N.Z., April 21

### "Cuprous Chloride Cell"

As the account given of my cuprous chloride cell in your report (NATURE, vol. xxvi. p. 96) of the Proceedings of the Royal Society of Edinburgh is rather misleading, I hope I may be excused if I make a few remarks on the subject. It is there stated that my cells suffered greatly from loss. This is not a correct statement. There are two ways in which the work expended in charging a secondary battery is lost. When a secondary battery is being charged, the E.M.F. between the terminals of the battery is higher than the normal E.M.F. of the

battery with open terminals, work being expended in heating the cells. When the charged cells are used to supply a current, the E.M.F. between the terminals is lower than the normal E.M.F. with open terminals, work being again spent in heating the cells. This source of loss is unavoidable, and is a practice very serious. I need only refer to the recent experiments in Paris with Faure accumulators, which were, I think, reported in NATURE. The second source of loss is the local action in the cell. This depends upon the chemistry of the cell. I have found the estimation of loss from this cause a difficult matter, but I think I am justified in saying that the loss from this cause in my cell is very small, when it is properly constructed. In fact, when used as a primary, its advantage is that it does not suffer from diffusion and consequent local action as all double-fluid cells do. I think it deserves a trial as a primary battery on this account. It is necessary to protect the cuprous chloride from air, covering it with water being quite sufficient. If this is done it should be a very durable form of cell.

A. P. LAURIE

King's College, Cambridge

[The statement that the cells suffered greatly from loss is in our report coupled with an additional statement which implies that other secondary cells have the same fault; so that Mr. Laurie is in no worse predicament than other inventors of secondary batteries. Unless Mr. Laurie's cell is in this respect superior to others, the report can hardly be regarded as misleading.—Ed.]

### Physico-chemical Lecture Experiments

A VERY striking lecture experiment, which I have never seen performed or described, and which illustrates the reaction, by double elective affinity, of *dry solids*, is the trituration together in a mortar of corrosive sublimate and iodide of potassium. The result is a brilliant scarlet coloration of iodide of mercury. If a large crystal of the one is rubbed on a crystal of the other, a scarlet precipitate (if the word may be so applied) is formed at every point of contact. From the brilliancy of the colour the experiment may be readily seen by a large number of spectators.

June 5

LEIGH CLIFFORD

### CUPS AND CIRCLES

AN important addition to the literature of "Cups and Circles" and Cup-marked Stones,<sup>1</sup> has just been issued as part of the fifth volume of "Contributions to North American Ethnology," printed by the Department of the Interior in their series of the publications of the U.S. Geographical and Geological Survey of the Rocky Mountain Region. The literature of the subject as regards the Old World is already extensive, and the object of Mr. Rau's work is to collect and systematise the existing information regarding the "cup and ring cuttings" that have been observed on rocks and boulders in Europe and India, and to add to this systematised knowledge an account of those that are now known in America.

The first monograph on these archaic forms of sculpturings on rocks and stones was that of A. E. Holmberg, on the Lapidary Sculpturings of Scandinavia ("Skandinavien's Hällristningar," Stockholm, 1848), but though copiously illustrated, it remained in a great measure a sealed book, from its being written in Swedish; and it was not till the publication of Mr. Tate's memoir on "The Ancient British Sculptured Rocks of Northumberland and the Eastern Border" (Alnwick, 1865); the exhaustive essay on the same subject by the late Prof. Sir James Y. Simpson, entitled "Archaic Sculpturings of Cups, Circles, &c., upon Stones and Rocks in Scotland, England, and other Countries" (Edinburgh, 1867); and the larger work, prepared under the direction of the late Algernon Duke of Northumberland, entitled "Incised Markings on Stone found in the County of Northumberland, Argyle, and other Places, from Drawings made in the Years 1863 and 1864" (London, 1869) that the attention of archaeologists generally was awakened to the

<sup>1</sup> "Observations on Cup-shaped and other Lapidarian Sculptures in the Old World, and in America." By Charles Rau. (Washington, 1881.)

subject. Since that time a host of enthusiastic observers has arisen over Europe, and innumerable examples of "cups and circles" have been discovered and described. It is difficult to account for the fascination that allures men to the study and pursuit of these "pitted stones." They are neither beautiful, nor intrinsically valuable. They are often earth-fast boulders, too large for transport, and unsuitable for "collections." But there is an element of mystery about them, and the mysterious is often more attractive than the beautiful or the useful. They pique the curiosity of the ordinary observer by the obvious suggestion that they have a story to tell if they could be made to speak; and they whet the ardour of the scientific investigator by the equally obvious suggestions that they are the products of a definite human purpose, which may be discoverable from an examination and comparison of their special characteristics. Probably no series of archaeological remains has been more carefully examined, more minutely described, or more copiously illustrated, and if the accumulation of such a mass of detailed information regarding their typical forms and characteristics over wide areas should ultimately fail in determining the nature of the purpose or purposes for which they were produced it cannot fail to add largely to the extent and precision of our knowledge of an essentially obscure subject.

It is certainly a matter of great interest, whatever may prove to be its general significance, that "cup-stones" and "pitted stones," which are in many cases analogous to those in the Eastern Hemisphere, are found in the United States and other parts of the Western Continent. Perhaps the most remarkable of those found in the United States is one at Ironton, in Lawrence County, Ohio, which was first brought to the notice of European archaeologists by Prof. Daniel Wilson, in the *Proceedings* of the Society of Antiquaries of Scotland for June, 1875. It is a boulder of grey sandstone 3 feet long, 2 feet 7 inches wide, and a foot and a half high, weighing between 1000 and 1200 pounds. The surface of the stone is pitted all over by about 116 cups, whose average diameter is  $1\frac{1}{2}$  inches and their depth about  $\frac{1}{2}$  inch, and on one side of the block there are several grooves 4 or 5 inches long, shallow and circularly hollowed in the bottom, so that "a cylindrical stone applied in the direction of its length would have produced the grooves, and its end by rotation the cup-shaped cavities." Another cupped boulder of granite occurs at Niantic, in New London County, Connecticut. It has only six cups, varying from about 2 inches to  $3\frac{1}{2}$  inches diameter, and from  $\frac{1}{4}$  inch to almost 1 inch in depth. Mr. Rau does not notice a still more remarkable boulder of granite in Forsyth County, Georgia, 9 feet long,  $4\frac{1}{2}$  feet high, and 3 feet wide, of which Prof. Wilson has given a figure. Along one side of the boulder is a row of cups, eighteen in number, connected by an incised line or gutter, while the face of the boulder is covered with markings of single or double concentric circles, surrounding small cups in the centre. In some cases two of these circles are connected by a straight gutter. Two very large boulders on the bank of the Ohio, a few miles below Manchester, in Adams County, have been seen by Dr. Hill, but are not more precisely described than that they are of sandstone, the one having twenty-nine and the other thirty-seven cups. A large cupped boulder at Orizaba, in Mexico, has been figured in Lord Kingsborough's "Mexican Antiquities." Two boulders of sandstone in an old Indian town in Santa Barbara County, California, are covered with conical-shaped excavations and cup-shaped depressions. The largest is 25 feet long and 10 feet wide, and shows twenty-five excavations from 6 inches to 26 inches diameter at the surface, and 5 to 16 inches deep. In one instance a groove is cut between two of the basins.

"Cup-stones" or "pitted stones" of small size are also frequently found in the United States. The first of these

that has been noticed as obtained from the Indian Mounds in Ohio, was described and figured in "The Ancient Mounds of the Mississippi Valley," by Squier and Davis (Washington, 1848), and is now in the Blackmore Museum, Salisbury. It is a small block of sandstone, 6 inches by 8 inches, weighing between thirty and forty pounds, and presenting on its surface three detached cups—two confluent, one half-finished, and several which are apparently just commenced. They are slightly oval in shape, about  $1\frac{1}{2}$  inches in greatest diameter, and seven-eighths of an inch in depth. Still smaller stones, often water-rolled greywacke pebbles, with one or more cup-shaped indentations on their flattish sides are extremely common. The cavities are rough and irregular, and the explanation given of their purpose is that they were probably used by the Indians for cracking hickory nuts. Another variety of "cup-stone" with regularly rounded and well-smoothed cups is regarded as paint-mortars. But while some of the larger boulders with basin-like cavities, such as those from Santa Barbara County, California, may have been used as mortars for triturating grain, it is obvious that such an explanation cannot apply to the boulders with smaller cups, or to those cases in which the cups are hollowed in the perpendicular surfaces of stones and rocks.

Such cups, often surrounded by concentric rings, or by broken rings with a gutter passing from the central cup outwards through the part where the rings are interrupted, are found abundantly in the British Islands, and in France, Switzerland, Germany, and Scandinavia. They are sculptured on rocks, boulders, on monolithic and on megalithic monuments, on the stones of dolmens and cists, and on stones built into the walls of underground dwellings. Thus they occur in close connection with the habitations and the graves of prehistoric man in central and north-western Europe. In a few cases in Scandinavia they occur on sepulchral structures that are assigned to the Stone Age, but their associations, so far as these are determinable, are chiefly with the Bronze Age. In Britain, and especially in Scotland, their associations are largely with the Iron Age, and the Age of Bronze; but few, if any well-authenticated instances of their occurrence in association with the typical objects of the Age of Stone are upon record. On the other hand small, portable cupped stones have been found in cists and grave-mounds which are attributed to the Stone and Bronze Ages, both in Great Britain and Ireland. In Brittany the large stones of the dolmens are frequently sculptured with a variety of rude figures, among which cups and circles not unfrequently occur.

Perhaps the most remarkable examples in Scotland are the rock-sculptures at Achnabreac in Argyllshire, described and figured in Prof. Simpson's work, and a rock-surface on the shore of Loch Tay, recently described by Mr. J. Romilly Allen. Prof. Simpson described nearly a hundred examples of rock and stone surfaces thus sculptured, but this number has been more than doubled during the last year by two observers, Mr. William Jolly and Mr. Romilly Allen, the former working in the northern, and the latter in the central, districts of Scotland. In England the most curious examples are those on the moor at Ilkley, in Yorkshire, described in the *Journal* of the British Archaeological Association (1879), by Mr. Romilly Allen. In Ireland the most striking groups are those on the stones of the great chambered cairn at New Grange, in the valley of the Boyne, and those associated with the remarkable cairns in the Lough Crew Hills, described by the late Eugene Conwell.

Many theories have been advanced with reference to the presumable purpose of such "cups and circles." It has been suggested that their purpose was useful, that it was ornamental, that it was commemorative, and that it was religious. The utilitarian theory is disposed of by their position in situations where use of any kind is

almost impossible. The ornamental theory is negated by the fact that they occur so often in situations in which they cannot be seen, as for instance on the under sides of cist-covers. The commemorative theory admits of much being said in its favour, but fails to suit all the circumstances of the case. The theory that they fulfilled some purpose in relation to the religious observances of prehistoric man is perhaps the most plausible that has yet been suggested, and has the following arguments in its favour.

If this early system of sculpturing these enigmatic markings on rocks and stones originally had reference to a common idea connected with the religious observances of prehistoric times, the existence of some traces of this connection might reasonably be looked for in the superstitions of the area in which it was formerly prevalent. This, in point of fact, is found to be the case. In many parts of Sweden, these cup-marked boulders are known as *elf-stenar*, and are still believed by the common people to possess curative powers. They say prayers, and make vows at them, anoint the cups with fat (usually hog's lard), place offerings of pins and small copper coins in them, and when they are sick, they make small dolls or images of rags, to be laid in them. These facts are stated in the *Manadsblad* of the Swedish Academy of Science. Miss Mestorf, as quoted by Mr. Rau, is more explicit:—

"The elfs are the souls of the dead; they frequently dwell in or below stones, and stand in various relations to the living. If their quiet is disturbed, or their dwelling-place desecrated, or if due respect is not paid to them, they will revenge themselves by afflicting the perpetrators with diseases or other misfortunes. For this reason, people take care to secure the favour of the 'little ones' by sacrifices, or to pacify them when offended. Their claims are very modest: a little butter or grease, a copper coin, a flower, or ribbon, will satisfy them. If they have inflicted disease, some object worn by the sick person, such as a pin, or button, will reconcile them. A Swedish proprietor of an estate in Uppland, who had caused an elf-stone to be transported to his park, found, a few days afterwards, small sacrificial gifts lying in the cups. In the Stockholm Museum are preserved rag dolls, which had been found upon an elf-stone."

These superstitious practices are connected with actual cup-stones of prehistoric times, but there are others, for the practice of which cups have been made in modern times. In the *Proceedings* of the Berlin Anthropological Society for June, 1875, Dr. Veckenstedt called attention to the existence of cup-markings on the walls of the church of Cottbus, in Brandenburg. Since then, they have been discovered on the walls of churches in more than twenty different localities in Prussia, and also in Germany and Switzerland, and even in Sweden. They are usually on the southern side of the churches, near an entrance, and not beyond the height of a man's arm. According to some accounts, in Germany at least, the cups were believed to possess healing virtues, chiefly for charming away fevers, and in some instances these modern cups in the church walls have been anointed with grease, like the cups in the prehistoric *elf-stenar* of Sweden. In Posen a tradition refers to the cups on the church-walls as the work of damned souls who ground them out in the night-time.

The existence of this superstitious veneration for prehistoric cup-stones, and the continuance of the custom of forming cups (on the walls of Christian churches) for curative purposes, pre-supposes the religious character of the original system of which these twin superstitions are apparently direct survivals. No evidence exists within the area occupied by the prehistoric cup-stones of Europe by which the precise form of the natural religion with which they were connected can be determined. But a religion exists in whose observances cups and circles are

still made on rocks and stones. It does not exist in Europe, and there is no direct evidence that it ever existed within the European area, but it exists in the area which was the home of the Aryan race.

In the district of Nagpur, in India, Mr. Rivett-Carnac found a group of grave-mounds surrounded by stone-circles. The mounds contained burials after cremation, accompanied by urns and implements of iron. The circles round the mound are from 20 to 56 feet in diameter, are mostly formed of trap-boulders, but each circle has a few stones larger and more regularly-shaped than the rest, and on these stones he found sculpturings of cups and circles, which he recognises as analogous to the cups and circles of the European area. He has also found in Kumaon, close to the temple of Chandeshwar, a rock-surface, on which, in a space 14 feet by 12 he counted more than 200 cups, varying from an inch and a half to six inches diameter, and from half an inch to an inch in depth. These cups are occasionally surrounded by rings and connected by grooves, but the usual form is that of a simple cup. All these markings, whether on the rocks or on the stones of sepulchral circles, are old, so old that the natives attribute them to the giants. But in the temple itself the conventional symbols of Siva, as Mahadeva (The Generator), were in some cases represented by rough slabs with a cup and circle, or concentric circles with a radiating gutter rudely incised. The resemblance of these symbols to the European cup and ring cuttings is not so close as their resemblance to some of the sculpturings on Bald Friar Rock, on the Lower Susquehanna in Maryland. Mere resemblance of form, however important it may be in a tentative classification of things whose relations are unknown, is quite insufficient if not irrelevant as evidence of identity of purpose or significance. Symbols that are absolutely similar in form may have had widely different meanings and applications in different places, at different times. Mr. Rau observes that no one who has examined Mr. Rivett-Carnac's papers in the *Journal* of the Asiatic Society of Bengal (1879) can help admitting the striking resemblance between the cup and ring cuttings of India and Great Britain; and he is probably right in his inference that the close connection between cups and rings implies that both belong to one system of primitive sculpture, the single cup being merely the simpler form. The argument in favour of both forms being symbols of the *cultus* of the reciprocal principles of nature rests solely on the ground of a similarity of form which does not amount to identity. Even though an absolute identity had been established between the ancient and modern sculpturings, their identity of significance would still remain to be proved.

It appears from this extended survey of the phenomena of cup and ring cuttings on rocks and boulders that more progress towards the elucidation of the subject is to be made by the study of their differences and diversities than by the mere observation of general similarities of form and circumstances. It seems probable that there are some, such as the portable varieties, which had a utilitarian purpose. It is not improbable that others of larger size on boulders, such as the block under the entrance to the tumulus of New Grange, may have been merely ornamental; and there are considerations which forbid the absolute exclusion of the supposition that others may have been commemorative, or in some sense possessed of a religious connection and significance. But none of these conclusions can be reached by mere force of argument. If the problem is ever to be solved, its solution will be reached by research, by comparison of the phenomena of different areas, and investigation of the inferences deducible from them. With regard to the American forms, Mr. Rau observes that as the cups on the Cincinnati boulder are perfectly similar to those on many stones in the Old World, it is probable that they owe their origin to the same motives. If these motives arose from

some religious conception, we might feel inclined to trace the origin of American cup-cutting to Asia. But if, on the other hand, the cups were designed for a practical purpose, the custom of excavating them may have sprung up in America, as well as elsewhere.

### THE ECLIPSE EXPEDITION

THE following letter from its Special Correspondent with the English Eclipse Expedition, appeared in the *Daily News* of Tuesday:—

Sohag, May 19

Still at Sohag! but how different is the place now from what it was when I first sighted it—as it seems, years ago. Then the solitary steamer and the tents of the French party were hardly sufficient to break the shore line as we looked at it, alas for too long a time, from the place of our last *ensablement*. But now the steamer is lost in a fleet of dahabeahs, and the line of tents and shelters has been extended for some distance towards the town; but tents are coming down, the hot sand is being strewn with boxes, and in 24 hours nothing will be left but some brick piers, which the next high tide will make short work with. Yes, something will be left. Sohag will have taken its place in scientific history by the side of many other out-of-the-world places, which seem to be chiefly affected by eclipses, and its memory may still puzzle the dryasdusts of the future.

As the 17th approached the excitement of almost everybody visibly increased, and as the energy waned the tension waxed. A little wind eddy of fearful violence, which produced a small sand-storm on the land, and almost a waterspout as it tore its way out of sight across the Nile, after hurling down one of the French tents and driving the dahabeah occupied by the English party from its moorings, was almost a relief; and a further variety was introduced into the monotony of heat and work by the arrival of the dahabeahs and the final visit of the Governor-General to the astronomers and his new visitors, Aly Pacha Cherif (son of Cherif Pacha, Minister of Mohamet Aly); Osman Pacha Galeb, Governor-General of Assiout; Mahmoud Pacha, director of the Cairo Observatory; Mohamed Bey-el-Kakim, and others being among them. On this occasion the Governor-General Aly Pacha Riza was accompanied by Teidrous Effendi, chief judge, and Mohamet Effendi Kamil, one of the judges of his province, and his aide-de-camp Moustafa Effendi Sirry. The commandant of the garrison of Sohag was also in attendance. Moktah Bey, as usual, acted as interpreter, and the final arrangements for the eventful day were made. First among these the military guard had to be largely strengthened, for not only is a very pardonable curiosity a thing to be utterly suppressed during eclipses, but a whisper had gone abroad that the False Prophet of the Soudan had included the eclipsers in his anathemas, and even one fanatic in the camp at Sohag might give a deal of trouble. And at last the 17th came, ushered in by the finest morning we had had—(clouds had been terribly persistent for several previous days at the time the eclipse was to happen)—and when the observers turned out at dawn to put the final touches to their preparations the local excitement had begun to show itself. On the hill, under palm trees, between us and Sohag there was already a great crowd, which rapidly increased; but a cordon of sentries round the camp kept everything quiet within.

And now for the actual work. In an eclipse there are four critical points: the first, second, third, and fourth contacts, so called—the first when the moon makes its appearance on the sun, the second when its first totality obscures it, the third when the sun again reappears, and the fourth when the sun is quite clear of the moon again. It is of course with the totality—that is, the time that the sun as we know it is invisible between the second

and third contacts—that the physical astronomer has almost exclusively to do, but as some of the phenomena are visible slightly before totality the time has to be carefully watched. During totality this has to be done in the most steady manner, and the observer upon whom this duty falls has a most responsible task. In the English Observatory, to which I shall now confine myself, this fell upon Mr. Buchanan; and as the arrangement adopted this time was new, I will describe it. It was devised by Mr. Lockyer as the result of his Indian experience, when the timekeeper found it so difficult to keep the time and to observe the eclipse, which he had come 600 miles to see, that he resolutely turned his back upon the sun lest he should fail in his self-imposed task and so disturb the work of others. What one wants to know at any moment during an eclipse is for how many seconds the phenomenon is yet to be visible and when each ten seconds of the totality have flown away, as each observer has generally more than one thing to do, and the announcement of the timekeeper is the signal for changing his instrument. On this occasion a clock used for testing gas meters was employed, with a seconds pendulum set going at the moment of totality, and with a large dial marked 65, 60, 50, 40, and so on to 0; 65 being the number of seconds which it was thought would leave a safe interval for covering the lenses of all the cameras before the actual termination of the eclipse. The plan answered admirably. Mr. Buchanan sang out the times shown on the dial, and sketched the eclipse with perfect ease.

While the land was darkening and the sky and the Nile were beginning to put on those indescribable hues round which so much of the terror of eclipses is centred, and while the whispers on the hill at Sohag were beginning to surge into a sound—half roar, half moan—some eight minutes before totality, Mr. Lockyer announced the appearance of bright lines, indicating that our atmosphere was already dimly illuminated enough to permit of the atmosphere of the sun being seen through it, and it was easy to see by the rapid pencilling on a copy of Angström's map, which was arranged on a stand under the eye-piece of his spectroscope that observations in earnest had commenced. This went on, the image of the retreating cusp of the sun being carefully kept on the slit of the spectroscope, by Mr. Lawrence until Dr. Schuster, as had been arranged, announced the instant of totality. At this signal Mr. Buchanan said, "65 seconds," Mr. Lockyer left the spectroscope to study the structure of the corona with the telescope, and Dr. Schuster uncovered all the lenses of his camera—all four of them arranged on a single stand—and to all, except the observers, the sun's atmosphere shone out in all its splendour and majesty, and the roar increased on the hill. In the telescope the verdict was that the solar conditions of 1871 were again present; and at the signal "40 seconds more," the information to be gathered by the naked eye and the grating was to be sought by one observer, while the photographic plates had to be changed by another. At this moment the silence in the observatory was broken by shouts calling attention to a strange object among the fainter exterior details of the corona itself, which were more suspected than seen. There, one solar diameter to the right and one solar diameter long, was an exquisitely formed comet, complete with nucleus and tail, sweeping in a beautiful curve, in brilliancy almost, if not quite, equalling that of the very corona itself—a real photometer, in fact, of which we have not yet heard the last. As in the naked eye view there was a struggle with the comet, so with the grating there was a struggle of another kind. A prism or a diffraction grating used without lenses forms what is called a slitless spectroscope. The coronal ring is really used as a circular slit, and according to the substances present in the solar atmosphere we shall have rings or no rings; and if rings are seen, then their presence in